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Surgery in Motion

Surgical Reconstruction for Male-to-Female Sex Reassignment

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Please visit www.europeanurology.com and www.urosource.com to view the accompanying video.

Abstract

Background: The primary challenge of male-to-female reassignment surgery is to create natural-appearing female genitalia with neovaginal dimensions adequate for intercourse, neoclitoris sensitivity, and minimal risk of complications. Surgical positioning is an important component of the procedure that successfully minimizes the risk of morbidity.
Objective: We modified various vaginoplasty techniques to better position the urethral neomeatus in the proper anatomic location to minimize the chance for complications and enhance aesthetic satisfaction.
Design, setting, and participants: We retrospectively reviewed data stored in a prospective database for 24 consecutive patients who underwent male-to-female gender reassignment at a German university clinic between January 2007 and March 2011.
Surgical procedure: First, orchiectomy and penile disassembly are performed with the patient in the supine position. Both corpora cavernosa are resected with the patient in the lithotomy position, and neovaginal construction is accomplished with the incorporation of the penile urethra into the penile shaft skin. The glans is preserved and resized to form the neoclitoris. The assembled neovagina is inverted, inserted into the expanded rectoprostatic space, and secured to the sacrospinous ligament. Scrotal skin is tailored to create the labia.
Outcome measurements and statistical analysis: Complications and patient satisfaction with neovaginal depth, appearance, neoclitoral sensation, and capacity for sexual intercourse were evaluated.
Results and limitations: The mean neovaginal depth was 11 cm (range: 10–14 cm); median follow-up was 39.7 mo (range: 19–69 mo). All patients reported satisfactory vaginal functionality. One patient noted stenosis after 4 yr that was histologically confirmed as lichen sclerosus. Neoclitoral sensation was good or excellent in 97% of patients; 33% reported regular intercourse. No major complications were observed. Because this is a retrospective review to describe a complex reconstructive surgery and illustrate these techniques in the accompanying intraoperative surgery-in-motion video, no control group was undertaken.
Conclusions: Gender reassignment can be performed with minimal complications using penile skin with incorporated penile urethra and intraoperative repositioning of the patient to achieve adequate neovaginal dimensions for intercourse and neoclitoral sensation.

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1. Introduction

Options for individuals seeking care for gender dysphoria encompass five distinct stages: diagnosis, psychotherapy, real-life experience in an identity-congruent gender role, hormonal therapy, and sex reassignment surgery [1]. Prevalence rates for sex reassignment surgery are believed to be significantly underreported and depend on cultural

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acceptance and vary among populations, ranging from 1:11 900 to 1:45 000 for male-to-female reassignment and from 1:30 400 to 1:200 000 for female to male [1,2]. A recent report calculated the rates in Hokkaido, Japan, to be 1:25 000 for male to female and 1:12 000 for female to male [3]. Increasing number of patients appear to be seeking this surgery, possibly because of better acceptance by medical and reimbursement communities, published high satisfaction rates, and improved quality-of-life documentation [4].

Because sex reassignment surgery is not reversible, a comprehensive professional protocol is critical [5]. Legal requirements differ by country and can be an important consideration. For example, according to German law, vaginoplasty for male-to-female reassignment is categorized as a "major solution" and subject to different restrictions than hormone treatment [6–8]. Current international guidelines for vaginoplasty require two referrals and 12 mo each of hormonal treatment and real-life experience in the identity-congruent gender role, with long-term follow-up by endocrinologic and mental health professionals [1].

The ultimate goal of vaginoplasty is the creation of an aesthetically attractive vulva and a neovagina that enables effortless intercourse and full orgasm, that is, a feminine vulva, deep vagina, and hooded clitoris with sensation facilitating satisfaction [9]. However, the surgical procedure is still considered controversial. Most high-volume institutions report satisfactory outcomes [10], but few peer-reviewed reports with reliable statistics are available, and most patient series are small. Early techniques used multiple genital skin graft procedures, resulting in visible scars, undesirable hair growth, and shrinkage of vaginal capacity [5]. Further developments included nongenital skin flaps, penile-scrotal skin flaps, penile skin grafts, and complex revision vaginoplasties using vascularized intestinal segments [5]. Sacrospinal ligament fixation improved vaginal depth, and vulvoplasty using the glans penis for clitoral formation improved genital appearance and sensation [5,11].

Perovic et al. [11,12] used penile skin incorporating a urethral flap during vaginoplasty to achieve natural anatomic and physiologic characteristics. We modified this technique, as well as others, to reposition the patient during the procedure to avoid long periods in the lithotomy position. Positioning is an important component designed to place the urethral neomeatus in the proper anatomic location, to minimize the risk of morbidity, and to ultimately increase patient satisfaction. The purpose of this report is to describe this procedure and illustrate these techniques in the accompanying intraoperative surgery-in-motion video.

2. Methods and patients

2.1. Patients

Consecutive patients who underwent male-to-female reassignment at our department between January 2007 and March 2011 were included. All patients fulfilled the German health care and legal system requirements for gender reassignment and gave written informed consent.

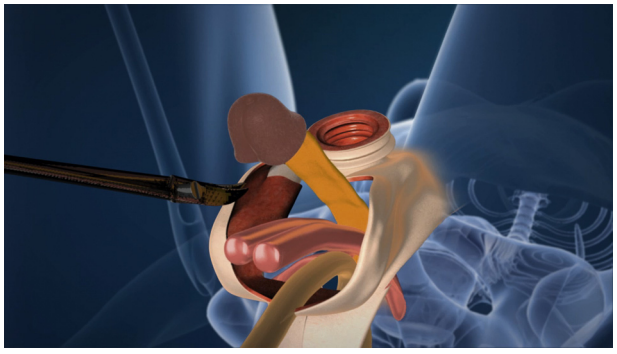

Fig. 1 – Penectomy (animation). Neurovascular bundle (yellow) with the glans (brown), cavernosal bodies (pink), and urethra with corpus spongiosum (ochre).

2.2. Surgical procedures

2.2.1. Orchiectomy, penile disassembly, and positioning

After the patient is shaved, pneumatic compression stockings (SCD, Kendall/Covidien, Dublin, Ireland) are applied. With the patient in the supine position, a midline scrotal incision is made for bilateral orchiectomy. An additional subcoronal circumferential incision is made (preserving the foreskin in uncircumcised patients) to free the penile skin including the superficial penile fascia down to the penoscrotal junction, where the first incision is located. The degloved penis is pulled through the scrotal opening (Fig. 1). The dorsal neurovascular bundle with the attached glans is carefully dissected from the corpora cavernosa using loupe magnification (×2.5). On the ventral side of the penis, the catheter-stented urethra is also freed from the corporal body to complete the penile disassembly. After removal of the catheter, the urethra is dissected from the glans at the meatus, freeing it from the glans. The sections of the disassembled penis are placed into the scrotum and covered with sterile gauze before the patient is repositioned to the lithotomy position.

2.2.2. Corporectomy and neovaginal reconstruction (labio-, clitoro,- and vaginoplasty)

With the patient in the lithotomy position, the scrotal incision is extended vertically to the penoscrotal and perineal junction. This lengthened position ensures an enhanced view to dissect the neurovascular bundle more posteriorly at the corpora decussate (Fig. 2). The urethra is similarly mobilized beyond corporal decussation until it takes an upward course toward the urinary bladder through the pelvic floor (central tendon or perineal body). When the neurovascular bundle with

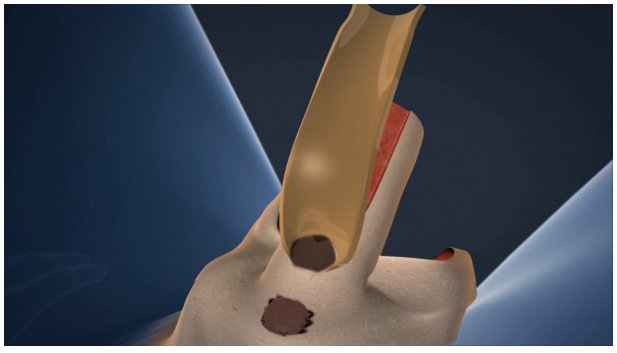

Fig. 2 – Scrotal incision: urethra (animation). The penile urethra (ochre) is dissected up to the neomeatus (brown), the neoclitoris is formed from the glans (brown), and the penile skin is incised (red/pink) to incorporate the penile urethra.

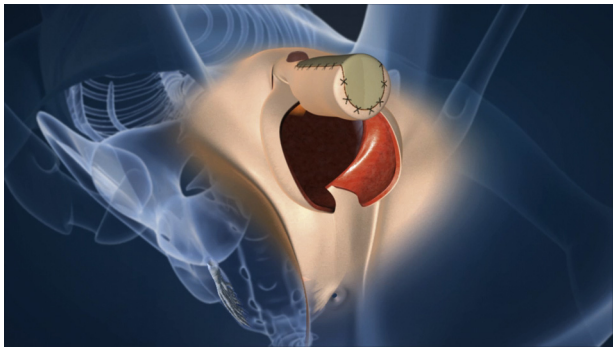

Fig. 3 – Neovagina: urethra (animation). The neovagina incorporating the penile urethra is complete.

the attached glans and urethra has been completely dissected, the corpora are resected as closely as possible to the inferior ramus of the pubic bone. This provides two benefits: (1) minimized bleeding because the corpora blood supply is easily identified and the shape of the male pelvis allows effortless vessel ligation, and (2) potential narrowing of the introitus of the neovagina during arousal due to remaining corpora pieces.

2.2.3. Neovagina creation

Next, the perineal body is sharply incised dorsally to the penetration of the urethra. Blunt dissection creates the rectoprostatic space anterior to Denonvilliers fascia, with the prostate dorsal and the rectum ventral to this space. An anal speculum facilitates the expansion of this space between the dorsal prostate and ventral rectum and provides better access to the right sacrospinal ligament to place two 2-0 absorbable sutures for subsequent neovaginal fixation. The neovagina is constructed

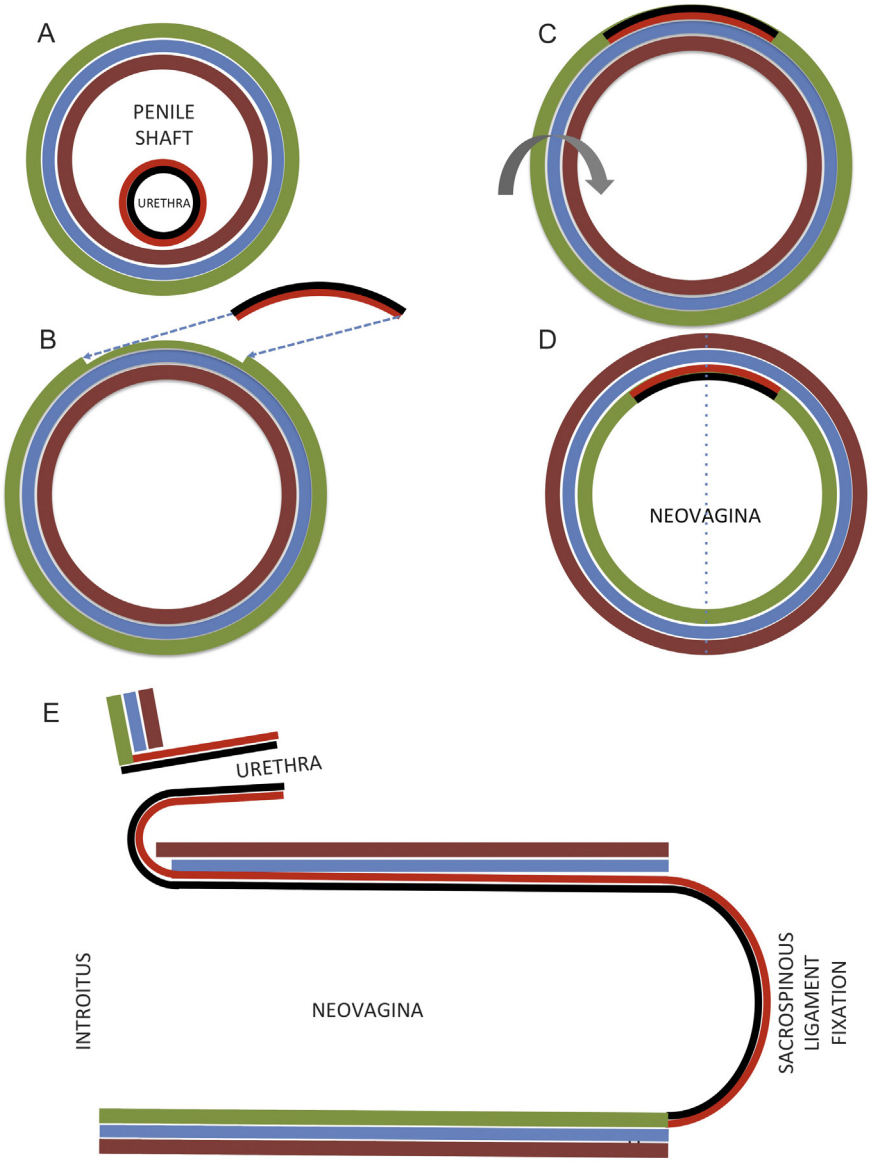

Fig. 4 – Visual surgical reconstruction. (A) Penile shaft with penile skin (green), superficial fascia (blue), and subcutaneous tissue (brown). (B) Longitudinal dorsal-incised penile skin (green) with preserved superficial fascia (blue) and subcutaneous tissue (brown), and longitudinal dorsal-incised urethra (black) with corpus spongiosum (red). (C) Incorporated urethral tissue into the penile tissue. (D) Inversion of the diameter-increased penile skin to form neovagina (dotted vertical line illustrates cross section of [e]). (E) Longitudinal cross section demonstrating urethral incorporation throughout the entire neovaginal length including the proximal coverage and closing of the neovagina.

of penile skin, and the spatulated urethra is inverted into this constructed space.

Significant attention to detail must be given. To increase the mons pubis of the vaginoplasty, we return to the upper portion of the scrotal incision. Initially, we free the subcutaneous fat from Scarpa's fascia of the symphysis (through the penoscrotal incision) to be able to move the entire lower abdominal wall into position to become the created mons pubis. The subcutaneous fat of this flap is fixed with tension with several 2-0 absorbable sutures to the fascia at the symphysis. With this step, the base of the penile skin flap, previously located at the upper edge of the symphysis, is moved to the distal edge of the symphysis to position the neoclitoris and neomeatus (Fig. 3).

2.2.4. *Neoclitoris and urethral meatus construction*

After creating the mons pubis, we fashion the neoclitoris and urethral meatus. The glans, vascularized and innervated by the intact neurovascular bundle, is reduced and shaped to become the neoclitoris. The portion of the glans above the previous situation of the meatus is thought to be the ideal remnant because of superior innervation. The neoclitoris is pulled through the cranial penile skin incision, positioned into the skin level at the former penile base, and secured with interrupted 5-0 absorbable sutures to the dorsal aspect of the incision.

The next step uses the urethral length (previously the penile urethra) to facilitate vaginal depth. The incision is made distally to the neoclitoris, facilitating the location of the urethral neomeatus. Dorsal spatulation of the dorsal penile shaft skin follows, with preservation of the superficial penile fascia (subcoronal towards the neomeatus) up to the previously made incision.

The penile skin is then carefully dissected to the superficial penile fascia laterally along the longitudinal skin incision, preserving vascularization of the penile shaft skin to provide space to incorporate the longitudinally spatulated penile urethra to increase neovaginal diameter. The urethra is then pulled through the neomeatus and longitudinally incised to become part of the neovagina, increasing the diameter (Fig. 4). The longitudinally incised spatulated urethra is sutured between the edges of the spatulated penile skin and embedded on the preserved superficial penile fascia with running 5-0 absorbable sutures along the whole length of the penile shaft skin (Fig. 4E). The proximal end of the urethra, which lies in conjunction to the base penile skin, becomes the neomeatus. The excessive distal ending of the spatulated urethra becomes the closing top of the neovagina (neocervix), which provides additional length to the neovagina. To stop operative bleeding of the corpus spongiosum, a running suture integrating the urethra into the penile skin is performed.

The previously placed 2-0 sutures anchor the neovagina to the sacrospinal ligament after they are passed through the cranial aspect of the neovagina (Fig. 5). If necessary, a closed-suction drain may be placed

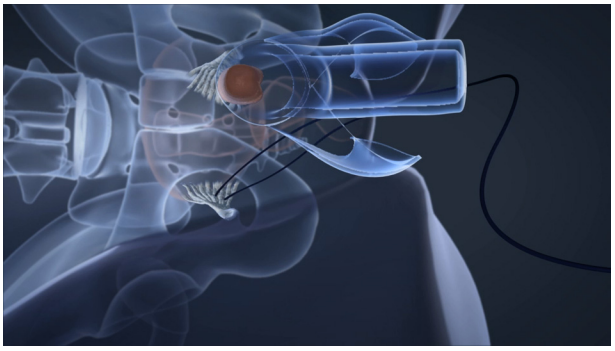

Fig. 5 – Neovagina creation (animation). Space for the neovagina is created. A suture is placed through the sacrospinous ligament for neovaginal fixation.

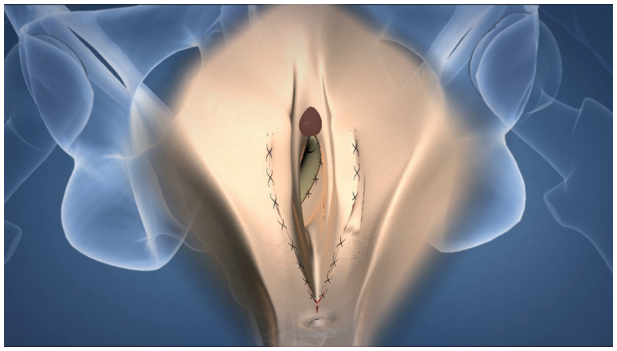

Fig. 6 – Male-to-female gender reassignment (animation). Situs completion. "x" illustrates skin closure with an intracutaneous suture.

para-neovaginally. The penile shaft is fixed with single 3-0 sutures to the public bone, creating the labia minora. The former scrotal skin is then fashioned laterally, creating the labia majora. The skin closure, using an intracutaneous suture, of the labia majora is folded toward the upper-inside leg to ensure a tension-free and almost invisible wound closure (Fig. 6).

The vagina is measured with Hager's dilator, and an appropriately sized inflatable vaginal stent (VS3010, 9.5 × 3 cm or VS3012, 12 × 4 cm; Coloplast, Hamburg, Germany) is inserted to preserve the vaginal depth for 6 d. Urethral and suprapubic catheters are used for 4–5 d to provide urinary drainage (Fig. 7). An x-shaped perineal compression dressing is applied to prevent postoperative hematoma or bleeding.

2.3. *Postoperative care*

Patients are mobilized the first postoperative day. Glycosaminoglycan (heparin) and diclofenac (Voltaren, 75 mg, Novartis) are administered. A second-generation cephalosporin antibiotic (cefuroxime) is continued until the urethral catheter is removed. All patients are provided with a

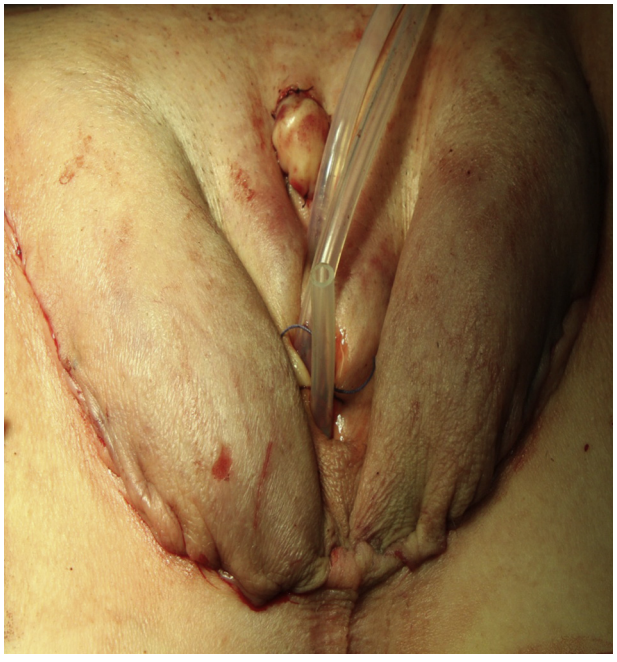

Fig. 7 – Postoperative: transurethral catheter and neovaginal dilatator (fixed with one stitch) in place.

Table 1 – Intraoperative and postoperative complications/corrections

Complications	*n* (%)	Annotations
Intraoperative		
Rectal injury	1 (4.2)	Small rectal lesion; closed immediately without colostomy
Bleeding	2 (8.3)	Two recent patients received fresh-frozen plasma to enhance healing process after impaired coagulation was noted during surgery
Postoperative		
Recto-neovaginal fistula	1 (4.2)	Primary closure transrectal within the first week after surgery (this was not the same patient as the one with rectal injury)
Cerebral ischemia	1 (4.2)	Partial paralysis of the right upper extremity; received immediate physiotherapy; complete remission
Bleeding	2 (8.3)	One minor hematoma/puncture; one neovaginal bleed caused by the patient's erroneous placement of the vaginal dilator (no transfusions required)
Meatal stenosis	1 (4.2)	Meatoplasty repeated three times to resolve meatal narrowing; the patient was diagnosed with lichen sclerosus 4 yr after vaginoplasty
Transient urge urinary incontinence	2 (8.3)	Treated with antimuscarinics for 6 mo
Neovaginal introitus stricture plus labia asymmetry	1 (4.2)	U-shaped introitus plastic and labia reduction resolved with minor surgery
Partial necrosis	1 (4.2)	Limited necrosectomy of urethral part of neovagina; healed over time
Secondary postoperative corrections		
Cosmetic corrections	13 (54.2)	Primarily mons pubis plasty and mucosa reduction

[*] No patient required a blood transfusion; no cases of thrombosis, compartment syndrome, peripheral nerve paralysis, infection, or swelling were observed.

postoperative protocol that includes a daily cleansing regiment. Patients are also given vaginal dilation training to maintain neovaginal size. During the first 2 mo, patients are instructed to remove the air-filled dilator twice daily and sit in a bath with chamomile extract. After the first visit, 6–8 wk postoperative, patients are allowed to have intercourse and change from the air-filled to a solid neovaginal phantom.

2.4. Assessments and follow-up

All data were entered prospectively into a database approved by an institutional review board that was queried retrospectively. Follow-up visits were scheduled for 1, 3, 6, and 12 mo, and annually thereafter. At each follow-up visit, patients were asked the following questions (English translation from German): (1) Are you satisfied regarding neovaginal depth, width, and cosmetic appearance? If not, would you prefer secondary cosmetic corrections? (2) How would you judge neoclitoral sensitivity (excellent/good/unsatisfactory)? (3) Do you have any regrets regarding the operation? (4) Have you been able to have intercourse? If so, do you need a lubricant? Have you experienced any pain or other problems? (5) Do you have intra-neovaginal hair growth? and (6) Have you been able to maintain the vaginal capacity provided by the operation? Data are reported for the last follow-up visit for each patient. At each follow-up evaluation, vaginal measurements (using Hagar dilators) were taken and postoperative protocol care was adjusted based on the patient's sexual activity.

2.5. Statistical analyses

Statistical analyses were performed with JMP software, v.9.0 (SAS Institute, Cary, NC, USA). The paired *t* test was used for pre- versus posttreatment comparisons.

3. Results

3.1. Patient characteristics

Twenty-four patients were included in the study. One 17-year-old was asked to wait to undergo surgery until her 18th birthday but was then included. The mean age of the study group was 39.1 yr (range: 20–54 yr).

3.2. Operative data and complications

The mean operating time was 300 min (251–394 min). Mean hemoglobin concentration (g/l) was 140 (standard deviation [SD]: 10; range: 114–157) preoperatively ($p<0.0001$) and 100 (SD: 10; range: 82–121) postoperatively. Platelet count (1×10^9/l) was 299.9 (SD: 89.0; range: 187–524) preoperatively ($p<0.001$) and 204.5 (SD: 57.3; range, 130–374) postoperatively. No patient required transfusion, and no thrombosis was observed. Complications were minimal (Table 1).

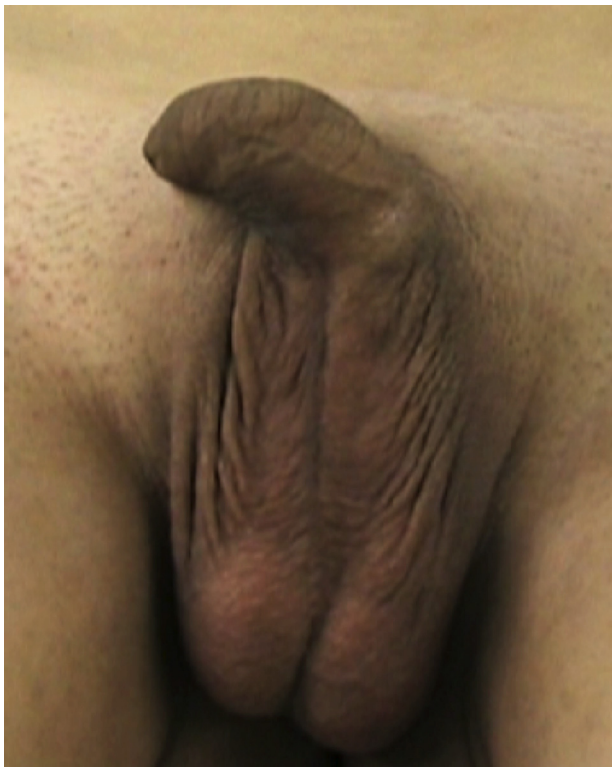

Fig. 8 – Representative patient: preoperative status.

Fig. 9 – Representative patient: postoperative.

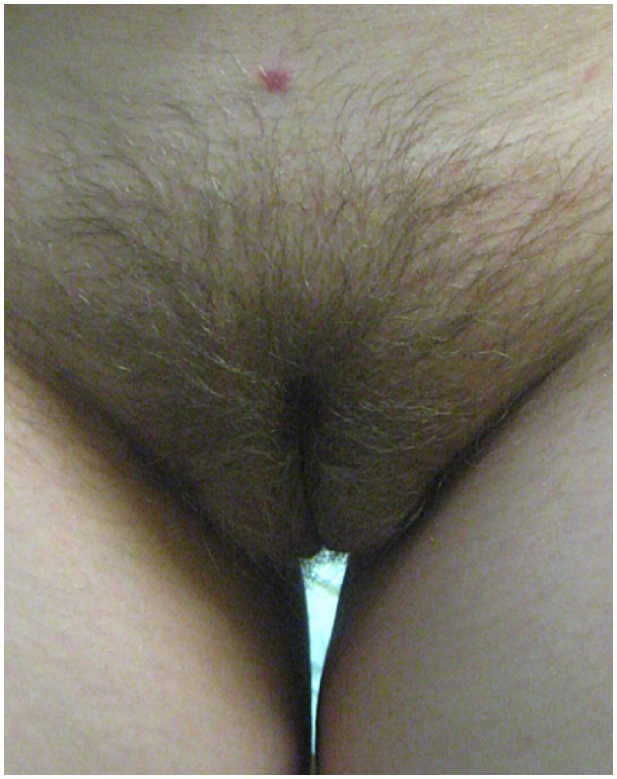

Fig. 10 – Representative patient: final postoperative neovaginal reconstruction.

3.3. Outcome and long-term satisfaction

The mean postoperative vaginal depth was 11 cm (range: 10–14 cm), with a diameter of 3–4 cm. Figures 8, 9 and 10 illustrate preoperative and postoperative appearance in three representative patients. Scar visibility was negligible (Fig. 10). To enhance aesthetic results, 13 patients (54%) underwent subsequent outpatient cosmetic adjustments of their vulva; one patient underwent a U-shaped introitus plastic and labia minor reduction.

The mean follow-up was 39.7 mo (range: 19–69 mo). Eight patients (33%) reported regular sexual intercourse. Table 2 presents the results of the custom questionnaire on patient satisfaction. Neoclitoral sensation was excellent in 18 patients (78%), good in 5 (19%), and unsatisfactory in 1 patient.

4. Discussion

Functional satisfaction in individuals who undergo sex reassignment surgery is highly dependent on sufficient neovaginal depth and neoclitoral sensation to achieve orgasm, as well as an attractive cosmetic result that fulfills the patient's aesthetic expectations. Our follow-up data showed overall patient satisfaction with the neovaginal dimensions. Table 3 highlights key points of the demonstrated technique.

We believe the incorporation of the entire spatulated penile urethra within the entire length of the penile skin increases neovagina dimensions and stretchability [12]; the sacrospinal ligament fixation preserves depth, with a decreased contracture rate due to well-vascularized mucosal tissue supported by preserved vascularization of the

Table 2 – Patient satisfaction as reported at last follow-up*

Question	*n* (%)	Annotations
1. Satisfaction with neovagina functionality (depth and width), outcome, and cosmetic results	24 (100)	
2. Satisfaction with sensitivity of neoclitoris	23 (96)	Stimulation of neoclitoris led to orgasm
3. Subsequent patient regret	1 (4)	Unrelated to surgical procedure; new life was not as fulfilling as expected
4. Reported intercourse	8 (33)	No pain or other limitations were noted; others reported no partner
5. Intra-neovaginal hair growth	0 (0)	No scrotal skin
6. Vaginal capacity loss	0 (0)	Patients diligently used dilators to secure depth

* Median follow-up was 39.7 mo (range: 19–69 mo).

Table 3 – Key points of the demonstrated surgical technique

Step	Modification	Goal
Patient positioning	Dorsal position until superficial penile disassembly; lithotomy position starting with deep disassembly	Reduction of complications (thrombosis, compartmental syndrome, nerve injury) due to reduced lithotomy position time
Thrombosis prophylaxis	Dynamic compression stockings	Prevention of deep vein thrombosis
Penile disassembly	Including of the prepuce (subcoronal incision)	Increased neovaginal depth
Cavernosal bodies	Complete resection of the cavernosal bodies with vascular control	Prevention of introitus narrowing during sexual arousal
Bulbus penis	Partial resection of the corpus spongiosum	Prevention of introitus narrowing during sexual arousal
Penile urethra	Incorporation into the penile skin	Increased diameter and width of neovagina (Fig. 4)
Neovaginal space	Use of anal speculum for placement of fixation sutures	Optimized exposure of the sacrospinous ligament to prevent neovaginal prolapse
Labia formation	Lateral resection of the excessive scrotal tissue sparing the tunica dartos with fat tissue	Individual formation of labia and inconspicuous location resulting in barely discernible scars lateral to the labia, so "natural" skin folds are close to the medial thigh

penile skin. Franco et al. [13] noted that some transgender individuals desired a longer neovagina than the natural female vagina of 8–10 cm in length. Incorporation of the urethra allowed us to achieve an average neovaginal depth of 11 cm. We also stressed frequent use of the vaginal dilator to encourage preservation of neovaginal capacity.

We used inverted and pedicled penile skin [14,15] to achieve satisfactory neovaginal size to avoid undesirable neovaginal hair ingrowth. The more invasive use of intestinal segments remains an option for complex cases if patients present with short penile length or previously failed vaginoplasty [16]. However, bowel segments or free skin grafts have possible side effects such as hair ingrowth, scar shrinkage, or extensive secretion [17], and they may be limited by excess secretions (bowel) or lack of sensation (skin grafts). Other publications have described surgical modifications preserving the inner layer of prepuce to avoid hair growth at the neoclitoris [18] by using a tunica albuginea strip to diminish damage to the neurovascular bundle [19]. This does not appear to be necessary with our technique because neoclitoral sensation essential for orgasm [20] was reported by all but one of our patients, comparable with other studies [21].

A reduced glans with a preserved neurovascular bundle has been successfully used for innervated neoclitoral formation, but neoclitoral necrosis may occur [18,22]. We believe that the dorsum of the glans facilitates vascular supply and is therefore a better choice.

Progressive obstructive voiding disorder due to meatal stenosis was reported as a major complication of penile inversion vaginoplasty [23]. Karim et al. [8] and Goddard et al. [21] reported neovaginal stenosis in 6–10% of patients after a combined penile-scrotal-skin-inversion technique. We found stenosis (due to lichen sclerosus) in only one patient (4%) 4 yr after surgery.

We used vaginal sacrospinous ligament fixation [24] to prevent postoperative neovaginal prolapse. Because of critical adjacent structures (vessels, nerves, and rectum), successful fixation of the neovaginal fornix to the sacrospinous ligament requires careful preparation and placement of the anchor sutures while an anal speculum is in place. With this technique, we had no case of prolapse, even in patients followed up to 69 mo.

Extensive time in the lithotomy position may cause leg compartment syndrome [25], compounding cardiovascular risk in patients receiving estrogen supplementation or who smoke. Our use of patient repositioning and pneumatic stockings during the operation is intended to prevent vein thrombosis, perineal nerve damage, and compartment syndrome. One patient had vascular compromise and cerebral ischemia without demonstrated thrombosis but achieved remission with physiotherapy before discharge.

Bleeding is a common complication of vaginoplasty and has been reported in 10% of patients, even with meticulous suturing [9]. Blood loss in our study was acceptable (40 g/l hemoglobin). In two patients who had intraoperative bleeding due to impaired coagulation, fresh-frozen plasma reduced bleeding and facilitated healing, leading us to consider eliminating postoperative closed drainage. Postoperatively, one minor episode of corpus spongiosum bleeding was stopped with a single suture. Another minor bleed was due to erroneous placement of the vaginal dilator.

Rectal laceration occurs in approximately 2% of patients and can lead to fistula formation or the need for a temporary colostomy [8,12,14,21]. Selvaggi and Bellringer [9] noted that fistula prevalence may be seriously underreported. We had one minor intraoperative rectal injury, which was closed immediately without sequelae, and one early postoperative fistula, which was addressed acutely. Extremely meticulous preparation, dorsally from the perineal body to the prostate along the Denonvilliers fascia up to the tip of the seminal vesicals, is important to avoid this serious complication.

Commonly reported functional urinary problems after vaginoplasty include stress urinary incontinence or urgency symptoms (66%), obstruction (33%), and urinary tract infections (2%) [21,26–29]. In our study, two patients had early postoperative urgency, successfully treated with oral antimuscarinics. No signs of stress urinary incontinence or neovaginal infection were observed.

Satisfying the patient's aesthetic goals is as important as achieving vaginal capacity [14]. At last follow-up, 100% of our patients were satisfied with neovagina functionality, outcome, and cosmetic results. Weyers et al. [30] noted that appearance, sexual arousal, lubrication, and lack of neovaginal pain are critical aspects of successful gender reassignment. Our patients who were sexually active denied

the need for additional lubricant during intercourse. However, all individuals reported use of a lubricant with the vaginal dilator. Only a third of our patients reported regular sexual intercourse. Although this figure may seem low, Franco et al. [13] noted that, for many patients, the pursuit of vaginoplasty is linked to personal identity rather than to a desire for sexual activity as a woman.

Because this is a retrospective review to describe a complex reconstructive surgery and illustrate these techniques in the accompanying intraoperative surgery-in-motion video, no control group was undertaken.

5. Conclusions

In our modified technique for male-to-female sex reassignment surgery, repositioning of the patient is undertaken to avoid complications due to long periods in the lithotomy position. We use penile skin with the entire penile urethra to construct a capacious neovagina with a properly positioned urethral neomeatus and intact sensation to the neoclitoris. At follow-up, patients reported satisfaction with function, lack of hair growth, barely perceptible external scars at the lateral aspects of the labia majora, and unchanged neovaginal length over time.

Author contributions: Joerg Seibold had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Study concept and design: Sievert.
Acquisition of data: Seibold, Amend.
Analysis and interpretation of data: Amend, Sievert.
Drafting of the manuscript: Amend, Sievert, Toomey.
Critical revision of the manuscript for important intellectual content: Stenzl, Sievert, Amend, Seibold.
Statistical analysis: Amend, Toomey.
Obtaining funding: None.
Administrative, technical, or material support: Toomey.
Supervision: Sievert.
Other (specify): None.

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Appendix A. Supplementary data

The Surgery in Motion video accompanying this article can be found in the online version at http://dx.doi.org/10.1016/j.eururo.2012.12.030 and via www.europeanurology.com.

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